REMARKS

Applicant thanks the Examiner for the very thorough consideration given the present application. Claims 1-2 and 5-7 are currently pending in this application. Claim 1 has been withdrawn from further consideration.

In view of the remarks herein, Applicant respectfully requests that the Examiner withdraw all outstanding rejections and allow the currently pending claims.

Issues Under 35 U.S.C. § 103(a)

Claims 2 and 5-7 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshida (U.S. 2003/0232450) (hereinafter Yoshida '450) in view of Takanori et al. (JP 2002-086399) (hereinafter Takanori '399). Applicant respectfully traverses.

The Examiner asserts that Yoshida '450 discloses a method for manufacturing a microfluidic device comprising the steps of: forming a resin layer 2 on a substrate 1, forming a groove or channel 5 by removing a portion of the resin layer by laser processing and forming a "throughhole" or inlet via laser processing. The Examiner acknowledges that Yoshida '450 does not teach or suggest the formation of subsequent resin layers to form a three-dimensional fluidic circuit and relies on the teachings of Takanori '399 to overcome this deficiency.

As to claim 2, Applicant respectfully submits that the Examiner has failed to establish a *prima facie* case of obviousness. To establish a *prima facie* case of obviousness, the prior art reference (or references when combined) must teach or suggest all the claim limitations. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). Additionally, there must be a reason why one of ordinary skill in the art would modify the reference or combine reference teachings to obtain the invention. A patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. *KSR Int'l Co. v Teleflex Inc.*, 82 USPQ2d 1385 (U.S. 2007). There must be a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does. *Id.* The Supreme Court of the United States has recently held that the "teaching, suggestion, motivation test" is a valid test for obviousness, albeit one which cannot be too rigidly applied. *Id.* Rejections on obviousness grounds cannot be sustained by mere

conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. *Id.*

The State of the Art and Technical Significance of the Present Invention

In recent years, development of a micro total analysis system (μ-TAS) has advanced, including applications of μ-TAS to genetic diagnosis, poison inspection, and the like. Particularly, if this technology is established in medical fields, high-accuracy biochemical analysis can be sanitarily performed. Further, μ-TAS have been used in an attempt to provide customized medical treatments by finding the causes of intractable diseases (see page 1, line 10 to page 2, line 20 of the present specification).

However, up until the present time, μ-TAS has not been successfully reduced to practice. The fluid flow path of the devices is micro-fine. If the devices are manufactured by means of impractical steps such as photolithography, which lacks design freedom (see Takanori '399), the manufacturing time and costs are so excessive so as to be unsuitable for practical enlargement in applicable fields.

In view of the above, alternatives have been proposed, such as a fluidic device, a part of which can be recycled (see Yoshida '450). However, this device has a two-dimensional (planar) fluid flow path. When a plurality of fluids is joined, respective fluids flow in parallel, and sufficient mixing of the fluids is not accomplished. Therefore, mixing must be forced by providing an electrode in the fluidic device, which reduces the cost-effectiveness of the device. In addition, in order to perform the above-described electrical mixing, the fluid is limited to fluids in which electric migration occurs, and thus, the scope in which the device can be applied is remarkably limited (see page 3, line 14 to page 4, line 3 of the present specification).

The present invention aims to solve the above-described problems. Thus, the objects of the present invention include (i) achieving a three-dimensional micro-fine fluid flow path capable of performing rapid mixing of fluids, (ii) manufacturing efficiency and cost-effectiveness, and (iii) possibility to recycle the substrate. The present inventor has accomplished the above-described objects and provides a practical method of manufacturing a micro fluidic device suitable for μ-TAS (see page 15, lines 16-20 of the present specification).

Thereby, the present inventor has reduced to practice a method applicable to new genetic diagnosis and biochemical analysis procedures, in a wide range of technology areas and medical fields, thus greatly contributing to public health.

Technical Features of the Present Invention

(a) Lamination of resin film layers

The present invention employs a step of stacking on a substrate resin films formed by a lamination method (see page 9, line 8 to page 10, line 1 of the present specification). This step is different from the step of processing using a coated film of a fluid resin (Takanori '399) and provides a film layer on a substrate which does not flow out of the resin because of its stable form. Thereby, handling and processing are largely improved by the method of the present invention.

(b) Formation of micro-fine fluid flow path by laser processing

The present invention employs a step of forming a fluid flow path by laser processing which utilizes a laser ablation phenomenon (see page 8, line 17 to page 9, line 7 of the present specification). Therefore, by arbitrarily moving a laser irradiating position, a fluid flow path can be formed in a desired shape without substantial limitation. For example, even complicated micro-fine three-dimensional fluid flow paths, as shown in Figures 1 and 2 of the present specification, can be manufactured by forming a groove and a hole in a desired form while each layer is precisely controlled. Accordingly, even when the structure of a fluid flow path is frequently changed in order to provide customized medical treatment to individual patients, the device of the present invention can effectively meet particular needs without cost increases.

(c) Lack of unnecessary materials and processing steps

According to the manufacturing method of the present invention, all fluid flow paths from an inlet to an outlet, as shown in Figures 1 and 2, are formed in laminated resin films. Accordingly, the above-described laser processing method is used to form micro-fine fluid flow paths in all film layers. The device of the present invention does not require unnecessary steps

and materials such as a pipe and a temporary substrate (Takanori '399), and high manufacturing efficiency and cost-effectiveness are accomplished.

Distinctions Over the Prior Art of Record

The present invention recites a method of manufacturing a microfluidic device, whose flow path, tank, and the like are formed in the order of micrometers, by repeating the specific lamination steps and groove formation steps. These steps are never described in either Takanori '399 or Yoshida '450. That is, according to the manufacturing method of the present invention, the microfluidic device is manufactured by repeating the lamination steps and the groove formation steps consecutively, for example, by laminating a resin film A on a substrate, forming a groove on the film A, laminating a resin film B on the film A to cover the film A, forming a groove on the film B, laminating a resin film C on the film B to cover the film B, forming a groove on the film C, and then repeating the above procedures subsequently according to need.

Takanori '399

(a) Takanori '399 requires processing by photolithography

The method of manufacturing a microdevice according to Takanori '399 necessarily requires 1) a step of coating a fluid resin on a temporary substrate to form a coated film, 2) a step of fitting a photomask to the coated film, 3) a step of photo-curing a part of the coated film by irradiating the part with an ultraviolet ray through the photomask, and 4) a step of washing out an uncured part of the coated film. Thereby, the coated film 2 having a deleted portion 3 on the temporary substrate 1 is formed, as shown in Figure 1 of Takanori '399 (see paragraphs [0185]-[0187]).

The photomask itself requires micro-fine processing accuracy, and thus, the manufacturing process is long and costly. In addition, because different photomasks must be prepared corresponding to changes in design of a fluid flow path, this largely increases the manufacturing cost of a fluidic device. Photolithography is complicated in its steps as described above, and Takanori '399 further employs a step of transferring a coated film (as described below), which requires an even more complicated procedure.

In stark contrast, the present invention requires laser processing. Therefore, the present invention has no relationship to photolithography.

(b) Takanori '399 requires a step of transferring a coated film with a temporary substrate

In Takanori '399, in order to keep and fix the shape of the deleted portion 3 of the coated film 2 formed on the temporary substrate 1, the coated film is transferred to the resin layer 5 on the main substrate 4 prepared separately as shown in Figure 3 of Takanori '399. Thereafter, the temporary substrate 1 is removed. Then, a substrate 6 having a resin layer 7 formed thereon is prepared separately from the main substrate 4, and the substrate 6 is bonded onto the transferred coated film 2' so that the resin layer 7 faces the transferred coated film 2' (see paragraphs [0188] to [0192] of Takanori '399).

In the method of Takanori '399, it is necessary to accurately transfer the coated film on the temporary substrate to the resin layer of the main substrate. In particular, in order to form a three-dimensional flow path, it is necessary to transfer accurately the deleted portion on the upper layer superposed onto the deleted portion of the lower layer. This process has a high level of difficulty, and the lack of accuracy can cause a misalignment in the resultant circuit because the process combines circuits whose circuit formations are completed to each other.

In stark contrast, the present invention requires no transfer processing using such a temporary substrate.

The present invention has a high degree of freedom of design and economic efficiency and is favorably suited to processing complicated and fine three-dimensional flow paths by laser processing each layer sequentially. Thus, the present invention is utterly different from Takanori '399.

Furthermore, in Takanori '399, the lamination is made after the formation of the grooves. Therefore, the order of the groove formation and the lamination is the reverse of the present invention.

Yoshida '450

Yoshida '450 relates to the formation of a planar flow path, and therefore, is different from the present invention, which relates to the formation of a three-dimensional flow path. In

Yoshida '450, the flow path is formed by closing a lid with a laminating step at the end of the process. The layer on which the grooves are formed is only a single layer. Therefore, Yoshida '450 neither describes nor suggests the formation of the three-dimensional flow path by forming grooves on a plurality of layers.

Combined teachings of Yoshida '450 and Takanori '399

As discussed above, the cited references, alone or in combination, fail to teach or suggest every limitation of the instant invention. For this reason alone, this rejection should be withdrawn.

As discussed above, in Yoshida '450, the flow path is formed by closing a lid with the laminating step at the end of the process, and the layer on which the grooves are formed is only a single layer. Neither description nor suggestion can be found regarding the formation of a three-dimensional flow path having a depth. On the other hand, in Takanori '399, the lamination is made after the formation of the grooves, and the order of the groove formation and the lamination is the reverse of the present invention. Furthermore, in the method of Takanori '399, photolithography is necessarily utilized as an essential element, but Takanori '399 does not utilize laser processing. One of ordinary skill in the art would never be motivated to combine Yoshida '450 and Takanori '399. Even if one of ordinary skill in the art did combine Yoshida '450 and Takanori '399, each and every element of claim 2 is not taught or suggested.

In the present invention, a groove having an arbitrary depth can be formed by utilizing laser ablation, and only the target layer (for example, the second layer on the substrate) can be processed without damaging a layer existing immediately beneath the target layer (for example, the first layer on the substrate). Therefore, the production efficiency is excellent. Furthermore, in the present invention, the degree of freedom in micro processing is quite high, so a groove having an arbitrary depth or a micro tank (which means a tank of the order of micrometers in size) can be formed. These advantages exhibited by the present invention are neither disclosed nor suggested in Takanori '399 or Yoshida '450.

According to the manufacturing method of the present invention, it is possible to three-dimensionally manufacture a micro-fine flow path showing an excellent function as described

above, even if a flow path structure has a complicated merge portion, with efficiency and cost-effectiveness (see, for example, page 7, lines 1-20). For the first time, the present invention provides a highly practical method of manufacturing a micro fluidic device which can be favorably used for μ-TAS and which can be manufactured on an industrial scale.

Furthermore, assuming *arguendo* that Takanori '399 cured the deficiencies of Yoshida '450, it is noted that references cannot be arbitrarily combined. There must be a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does. *KSR Int'l Co. v Teleflex Inc.*, 82 USPQ2d 1385 (U.S. 2007). Courts have clearly established that, even when a combination of references teaches every element of a claimed invention, a rejection based on a *prima facie* case of obviousness is improper absent a motivation to combine. *In re Rouffet*, 149 F.3d 1350, 47 USPQ2d 1453 (Fed. Cir. 1998).

Moreover, according to MPEP 2143.01, the combination of references cannot change the principle of operation of the primary reference or render the reference inoperable for its intended purpose. Since the Takanori '399 utilizes photolithography as an essential technology, it would be impossible to also apply the lamination method of Yoshida '450. Therefore, a *prima facie* case of obviousness has not been established, and withdrawal of the instant rejection is respectfully requested.

As noted previously, the present inventor has developed a novel process to three-dimensionally manufacture a complicated fluid flow path with higher accuracy than conventional manufacturing methods. The present method is also simpler and more cost-effective.

As discussed above, the present invention accomplishes (i) formation of three-dimensional micro-fine fluid flow path capable of performing rapid mixing and reaction of fluids, (ii) increase in efficiency and cost-effectiveness of the manufacturing process, and (iii) recycling of the device substrate. Accomplishment of those remarkably advantageous properties is neither disclosed nor suggested by the cited references. These results have never been accomplished before, thus evidencing the superior results obtained by the method of the present invention.

For the reasons given above, Applicant respectfully submits that claims 2 and 5-7 clearly distinguish over the cited prior art. As the above remarks address and overcome the rejection, withdrawal thereof and allowance of the claims are respectfully requested.

Request for Initialed Form(s) PTO/SB/08

In reviewing the application file, the undersigned has noted that the appropriate initialed Form PTO/SB/08 in response to the Information Disclosure Statement(s) (IDS) filed on May 12, 2005 has not been received by Applicant. The Examiner is therefore requested to return a copy of the initialed Form PTO/SB/08 to the undersigned as soon as possible.

CONCLUSION

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider all presently outstanding rejections and that they be withdrawn. It is believed that a full and complete response has been made to the outstanding Office Action and, as such, the present application is in condition for allowance.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Marc S. Weiner, Reg. No. 32,181, at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§ 1.16 or 1.14; particularly, extension of time fees.

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Respectfully submitted,

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